



EdgePoint PRO Product Description Document

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Revision History

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Revision Numbering Key

0.x	Work in Progress
1.0	Initial Document Approval
1.x	Revision Following Initial Document Approval
2.0	Revision Approval

Table of Contents

TABLE OF CONTENTS	3
1 INTRODUCTION	4
1.1 PROPRIETARY INFORMATION NOTICE	4
1.2 PURPOSE OF DOCUMENT	4
1.3 SCOPE.....	4
1.4 TERMINOLOGY	4
1.5 APPLICABLE DOCUMENTS	4
2 EDGEPOINT PRO FEMTO SYSTEM INTRODUCTION	6
2.1 ARCHITECTURE OVERVIEW	6
2.2 EDGEPOINT NETWORK CONFIGURATION.....	7
2.3 EDGEPOINT PRO PACKAGING.....	11
3 EDGEPOINT PRO HARDWARE	13
3.1 EDGEPOINT PRO DIGITAL HARDWARE OVERVIEW	13
3.2 POWER PC.....	14
3.3 QUALCOMM CHIPSETS	15
3.4 GPS MODULE.....	15
3.5 NETWORK LISTEN FUNCTION	16
3.6 EFTR (ENTERPRISE FEMTO TRANSCEIVER) BOARD	16
3.7 1900 MHZ EFTR	17
3.8 800 MHZ EFTR	17
3.9 EDGEPOINT PRO FEU	17

1 INTRODUCTION

1.1 Proprietary Information Notice

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1.2 Purpose of Document

This document defines the unique IP and SIP based CDMA EdgePoint PRO Femtocell products developed by AirWalk Communications, Inc. The AirWalk EdgePoint PRO Family of Femto cells are commercially available, standards compliant, optimal channel capacity, cost effective, compact and reliable small footprint wireless radio access network systems that could be deployed in residential and enterprise environments to augment existing macro coverage. The EdgePoint PRO Femto cells can also provide coverage in areas where the service providers hold valid licenses but do not have macro coverage or cell sites. The AirWalk EdgePoint PRO are available as a combination product that supports 1XRTT and 1XEVD0 networks simultaneously, also included on the board is a 10 frequency hopping plot beacon, used to attract mobiles to the device. For 1XRTT, the Base Station Transceiver (BTS) and Base Station Controller (BSC) are integrated into a unique single board computer that can use SIP signaling or IOS to support voice and data call processing. Similarly for 1XEVD0, the RN and RNC are integrated into a single board computer. The combination 1XRTT/1XEVD0/PB product integrates the BTS, RN, BSC and RNC onto a single board computer.

1.3 Scope

The scope of this document covers the functional, performance, and environmental specifications of the AirWalk EdgePoint PRO family of Femto cells.

1.4 Terminology

See Section 6 -ACRONYMS

1.5 Applicable Documents

The following documents are applicable to the extent specified in this Product Description Document.

- TIA/EIA/IS-2000 Series Revision: C - Introduction to CDMA2000 Spread Spectrum Systems, 05/00/02
- Personal Station – Base Station Compatibility Requirements for 1.8 to 2.0 GHz CDMA PCS.
- TIA/EIA-664 - Wireless Features Description, 12/00/00
- TIA/EIA Interim Standard 95 Revision A - Mobile Station –Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular Systems, May 1995
- TIA/EIA-95-B - Mobile Station-Base Station Compatibility Standard for Dual-Mode Spread Spectrum Systems, October 31, 1998
- MSC to BS Interface Inter-Operability Specification (IOS) Sprint PCS IOS Document, v2.0a, December 4, 1997
- IMT-2000 Specification, (indoor wireless propagation)
- RFC 3261- SIP: Session Initiation Protocol

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- RFC 4566- SDP: Session Description Protocol
 - RFC 5491- GEOPRIV Presence Information Data Format Location Object (PIDF-LO) Usage Clarification, Considerations, and Recommendations
 - RFC 3428- Session Initiation Protocol (SIP) Extension for Instant Messaging
 - RFC 4306- Internet Key Exchange (IKEv2) Protocol
 - 3GPP2 X.S0059-200-0- cdma2000 Femtocell Network:1x and IMS Network Aspects, v1.0, January 2010
 - TR-069 CPE WAN Management Protocol v1.1 Amendment 1
 - TR-143 Enabling Network Throughput Performance Tests and Statistical Monitoring
 - 3GPP2 C.S0024-A cdma2000 High Rate Packet Data Air Interface Specification
 - 3GPP2 A.S0008-C_v2.0 Interoperability Specification (IOS) for High Rate Packet Data (HRPD) Radio Access Network Interfaces with Session Control in the Access Network
 - 3GPP2 A.S0011-D Interoperability Specification (IOS) for cdma2000 Access Network Interfaces

2 EdgePoint PRO Femto System Introduction

2.1 Architecture Overview

The AirWalk EdgePoint PRO Femto system uses standard IOS Architecture defined in 3GPP2 standard. The below diagram depicts the Architecture Reference Model defined in this IOS specifications. The solid line indicate the signal and bearer where as the dashed line indicate the signaling only.

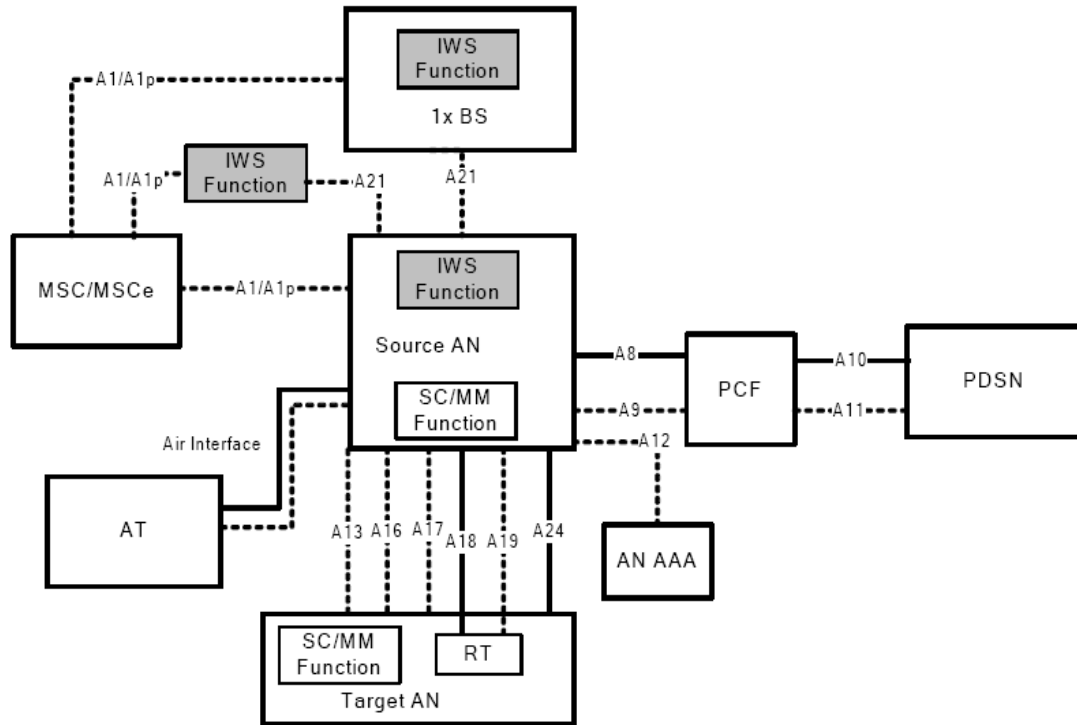


Figure 1- IOS Network Architecture

Following are the description of the all the A-interfaces AirWalk uses:

A1 – Interface carries signaling information between call control and mobility management function of the circuit-switched MSC and IWS function.

A1p – Interface between 1x and HRPD system that uses instead of A1.

A8/A9 – AirWalk proprietary interface that carries user traffic between AirWalk software within AN and PCF.

A10/A11 – Interface with between AirWalk PCF and PDSN

A12 – Interface between AirWalk AN, and AN-AAA for the authentication of SC/MM (Session Control/Mobility Management).

A13/A16/A24 – Interface between AirWalk AN to AirWalk AN during handoff signaling for idle mode (A13) and active mode (A16). A24 holds a buffer from source AN to target AN.

2.2 EdgePoint Network Configuration

The AirWalk EdgePoint PRO family of femto cells is CDMA devices that are capable of simultaneously supporting 1XRTT and 1XEVD0 networks along with a 10 frequency hopping pilot beacon on the same device. The EdgePoint and EdgePoint Pro femto cells are configured and maintained using standard based TR069 with a proprietary device model. Each device is also equipped with a network listener (NL) that is used to sense the current radio environment for purposes of auto-configuration.

The EdgePoint femto can be configured to provide additional functionality such as RF mitigation, an onboard Ethernet switch and an analogue telephone adapter for supporting independent wireline phone support. The 1XRTT call support uses SIP and RTP for signaling and bearer respectively, optionally the 1XRTT call can also be supported using standards based 3GPP2 IOS 5.x for signaling.

The EdgePoint residential device comes in an attractive desk top packaging that adds luster to any home furnishing. The EdgePoint Pro is an enterprise unit that comes in a standard rack mount form factor or an attractive yet non-obtrusive wall mount unit.

The EdgePoint Femto cell is a key element in the AirWalk CDMA End-To-End Network Solution. The EdgePoint Femto cell provides a radio communication link to the mobile subscriber devices using the CDMA air interface protocol. The EdgePoint Femto cell fills in gaps in coverage and also can provide primary coverage in areas that suffer from poor or non-existent CDMA coverage. The combo EdgePoint Femto cell gives the service provider an option of using a next generation IMS core or a MSCe at the core to provide voice and data service. The EVDO capability of the femto cell, provides service using the existing PDSN and AN-AAA devices.

A Femto BSM (U-BSM) automatically provisions an EdgePoint Femto cell for service by using data on the radio environment, provided by the Femto Cell network listen function, along with service provider policies. The U-BSM also provides configuration management, performance management and fault management either on demand or autonomously.

The following figure shows the AirWalk EdgePoint Femto Cells and its relationship to the CDMA Core Network elements.

Together with an IMS, a Convergence server, PDSN and AN-AAA components, the AirWalk EdgePoint Femto cell provides an end to end personal or business CDMA wireless solution. As shown below, the EdgePoint Femtocell devices utilizes common interfaces to the core network equipment, consisting of IPSEC and SIP to the IMS core or IOS-4.2+/5.0 to a MSCe, and RTP to the Media Gateway, A10/A11 to the PDSN and TR069 to the U-BSM..

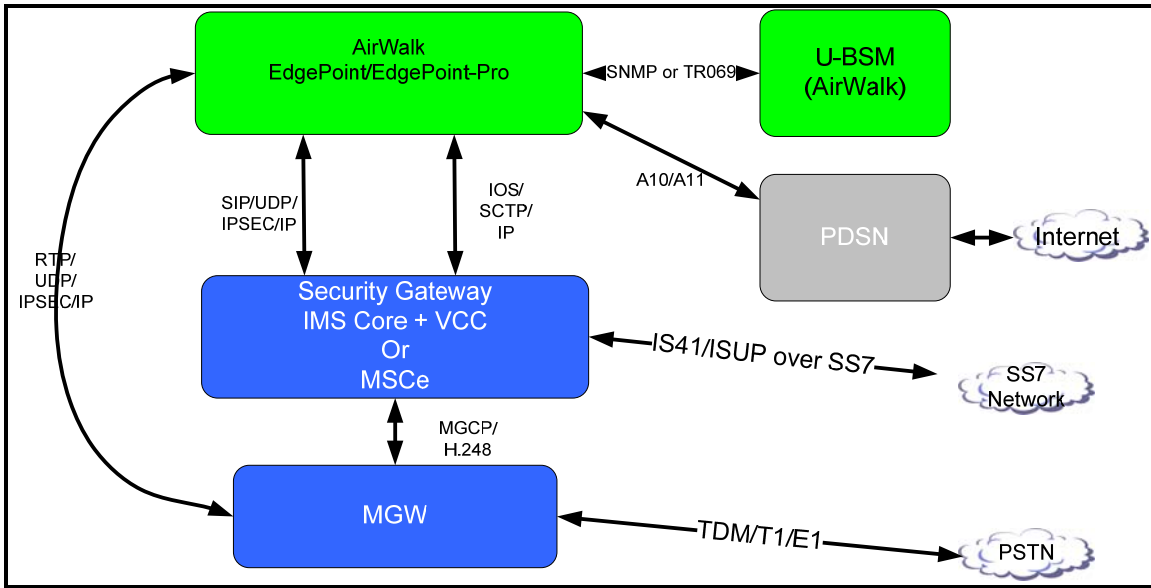


Figure 2 - AirWalk Network diagram

The AirWalk EdgePoint Pro utilizes the customer premise existing IP connection to the IP core and Internet. The base interface of the device is IP over Ethernet and is capable of using IP provided by DSL, Cable, Fiber or bonded T1 besides other not as common technologies. In addition to using standard IP the EdgePoint provides secure communication over IP by the use of IPSEC to interconnect to security gateways and Femto gateways.

As mentioned on section 2.2, AirWalk EdgePoint/EdgePoint PRO 1xRTT contains two different paths to set up a voice paths. Figure 3 shows the SIP-IMS implementation consists of several key components within the network. It requires IMS core that will support CDMA interface. Also for this network diagram, it is assumed that Security Gateway, SG, is provided by the operator to allow the service to be manageable in IP-Security across the network.

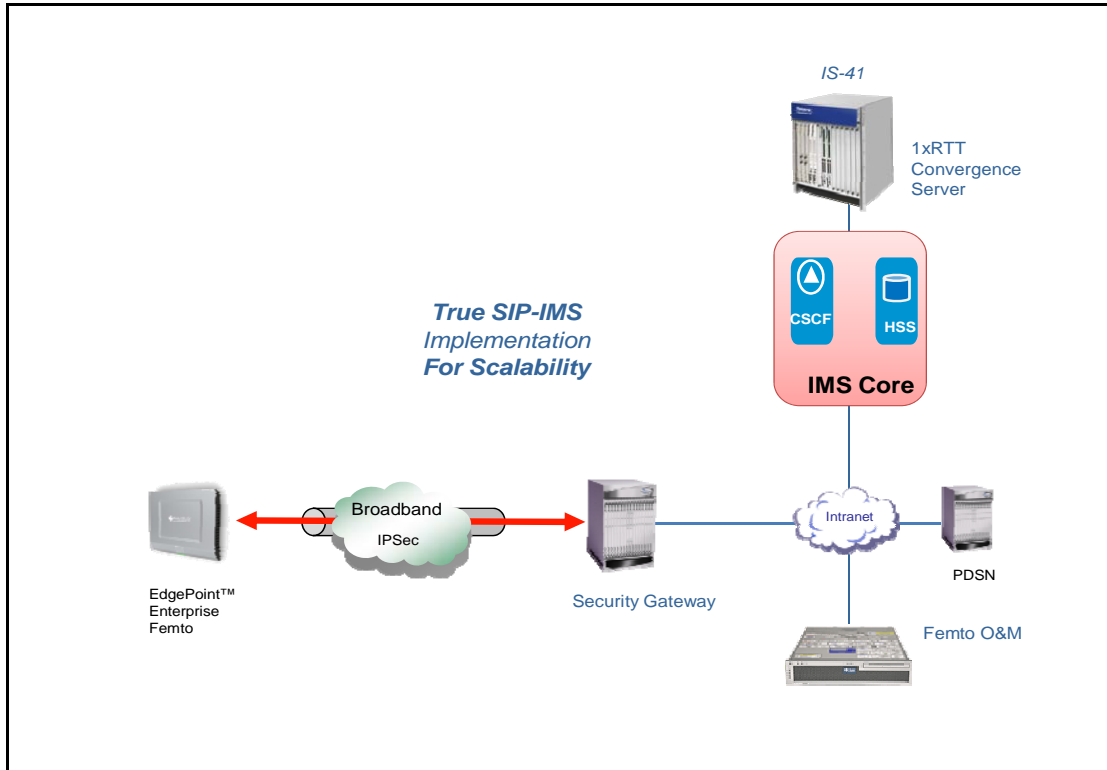


Figure 3 - EdgePoint Pro 1xRTT on SIP/IMS core

The EdgePoint 1xRTT voice can also be supported on standard IOS 5.x interface to CDMA soft switch. The soft switch is a more traditional interface consisting of soft switch that supports CDMA signaling to set up a mobile call. In addition, the voice network will also require HLR/VLR to authenticate mobiles that are in the network instead of IMS core. The Figure 4 depicts the more traditional soft switch network diagram for the 1xRTT voice path.

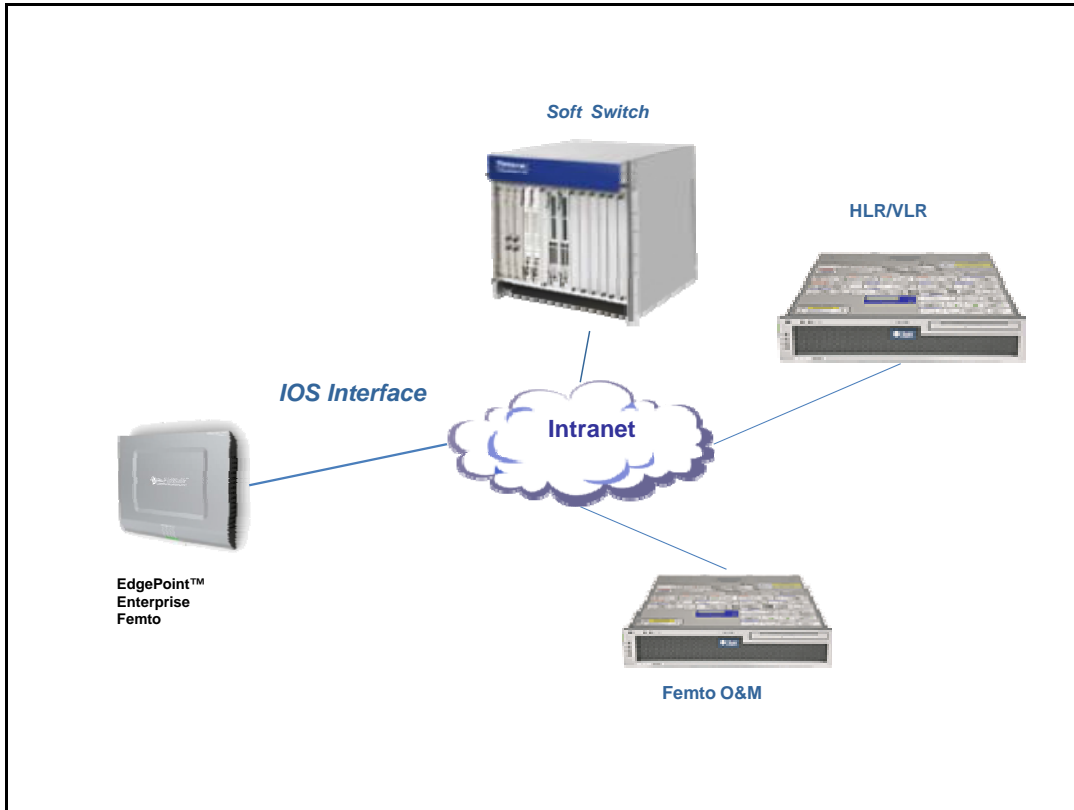


Figure 4 - EdgePoint Pro 1xRTT on Soft Switch

In addition to voice networks mentioned in Figure 3 and 4, EdgePoint PRO cell also provide data centric service such as 1xEVDO network. Below diagram, Figure 5, depicts 1xEVDO network diagrams that require A10/A11 interface with PDSN and A12 interface with AN-AAA which performs the authentication functions for the EdgePoint PRO.

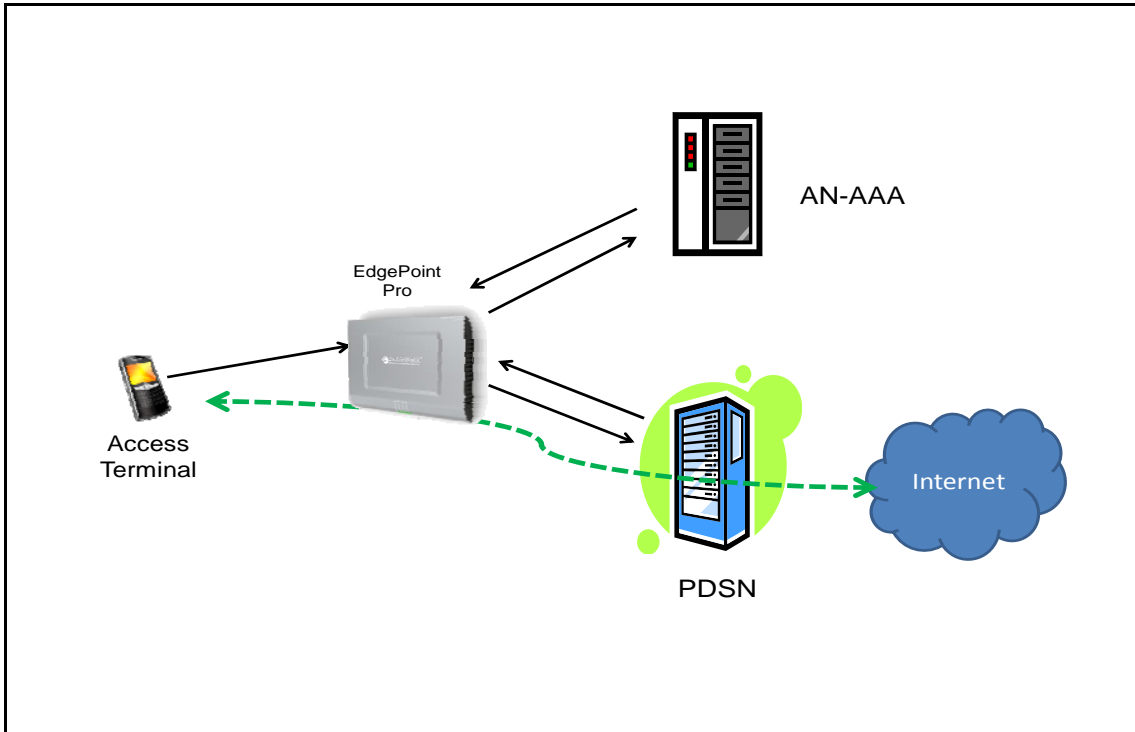


Figure 5 – EdgePoint PRO 1xEVDO

2.3 EdgePoint PRO Packaging

The EdgePoint PRO is packaged for enterprise use. The units can be rack mounted or wall mounted as desired. The wall mount units are designed to be aesthetically pleasing to the office environment adding a touch of futuristic design to the office environment. Below are pictures of the EdgePoint Pro. The Figure 6 shows the rack mount version of the EdgePoint Pro, and the Figure 7 shows the wall mount models.



Figure 6 – EdgePoint PRO Rack Mount Design



Figure 7 - EdgePoint Pro Wall Mount Design

Both type of packaging contain same digital board which will be described in more detail in section 3. The section 3 will describe the hardware components of the EdgePoint PRO. The section 4 will describe the software modules that make up the EdgePoint PRO. Finally, section 5 shows EdgePoint PRO boot-up sequence of operations. The EdgePoint PRO is unique in that it has the plug-n-play nature of the management system. The unit will come up automatically and goes through several self checks. Therefore, this section is required to explain the flow of operations since it does not operate like the regular RAN provisioning.

3 EdgePoint PRO Hardware

The EdgePoint PRO architecture combines the traditional concepts of the BSC, BTS, AN, ANC, and PCF into a homogeneous architecture. The EdgePoint PRO provides signaling, voice and data is connected to the core using the existing connection to the internet (Cable, DSL, fiber, bonded T1). In order to provide these services, the EdgePoint PRO needs several major components. In section 3, major hardware components are introduced and described.

3.1 EdgePoint PRO Digital Hardware Overview

The EdgePoint PRO architecture is based on a Freescale MPC CPU operating on VxWorks RTOS, Real Time Operating System. The device is capable of supporting 1XRTT and 1XEVD0 simultaneously. The EdgePoint PRO support 28 voice calls in its 1XRTT configuration, and 32 data calls in 1XEVD0 simultaneously. The EdgePoint PRO is comprised of digital and radio portion. The Figure 8 depicts all the components that are part of the digital portion of the board.

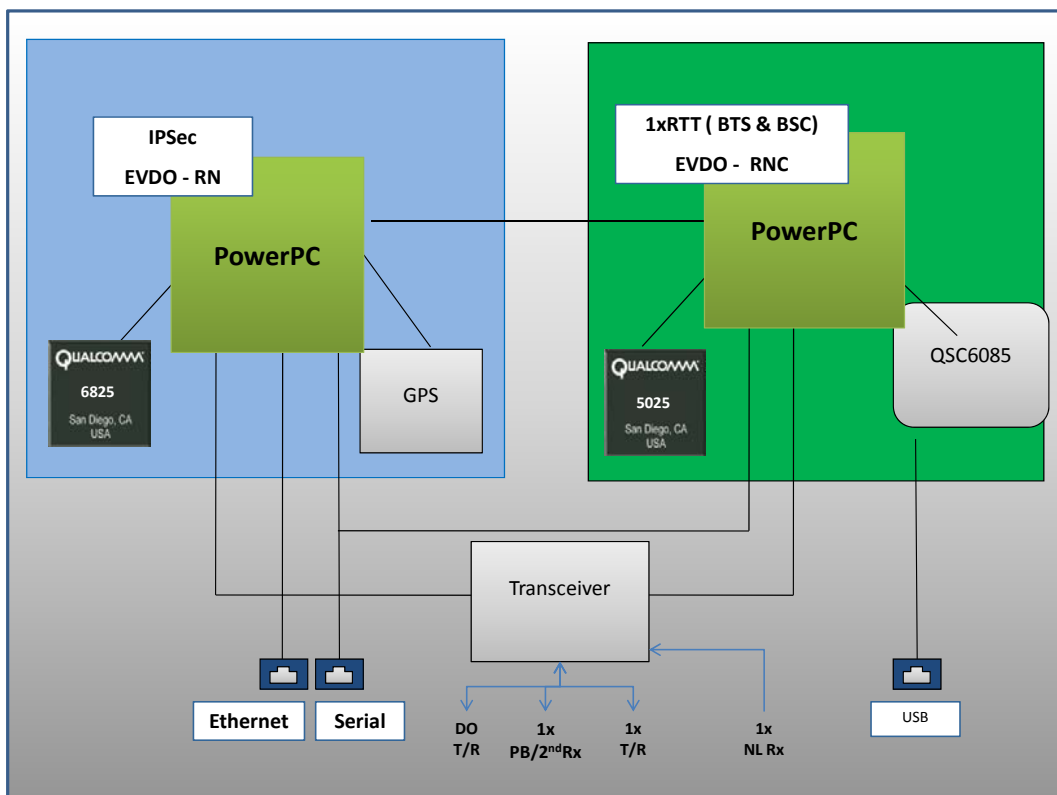


Figure 8 - EdgePoint Pro Digital Board

The major hardware components on the digital board include Freescale PPCs as its main processing units. It also holds a Qualcomm CSM 5025 for 1XRTT and a Qualcomm CSM 6825 for 1XEVD0 for the CDMA baseband signals. For the three Lime XCVRs, LM0006 is used for the RF signal modulation. The GPS module provides timing synchronization and location information. In addition it has mobile handset receiver that will work as a network listener to sweep neighboring cell information. Finally, there are three different communication ports, an

Ethernet, serial, and USB ports to provide debug and communication interface to external devices.

3.2 Power PC

The EdgePoint PRO comprises of two PPCs processors (MPC8347) and controls other components within the EdgePoint-Pro device like Qualcomm chipsets, GPS module, Network Listener, and transceiver (XCVR). The PPC provide critical role within EdgePoint PRO and below are some of the highlights of PPC's function:

1. The PPC handles the IPSec communication that interface with security gateway, SG.
2. The first PPC handles 1xEVDO RN portion of the packet flow by interfacing with CSM6850 chipset. PPC packetize the received air message and packetize them. The packetized data is sent to PDSN.
3. The second PPC handles 1xRTT portion of the call processing as well as the RNC side of the signaling messages. This is accomplished by interfacing with CSM5025 chipset.

Below figure 9 shows the PPC's functionality and some of the controlling block. It also depicts the packet flow of the EdgePoint PRO:

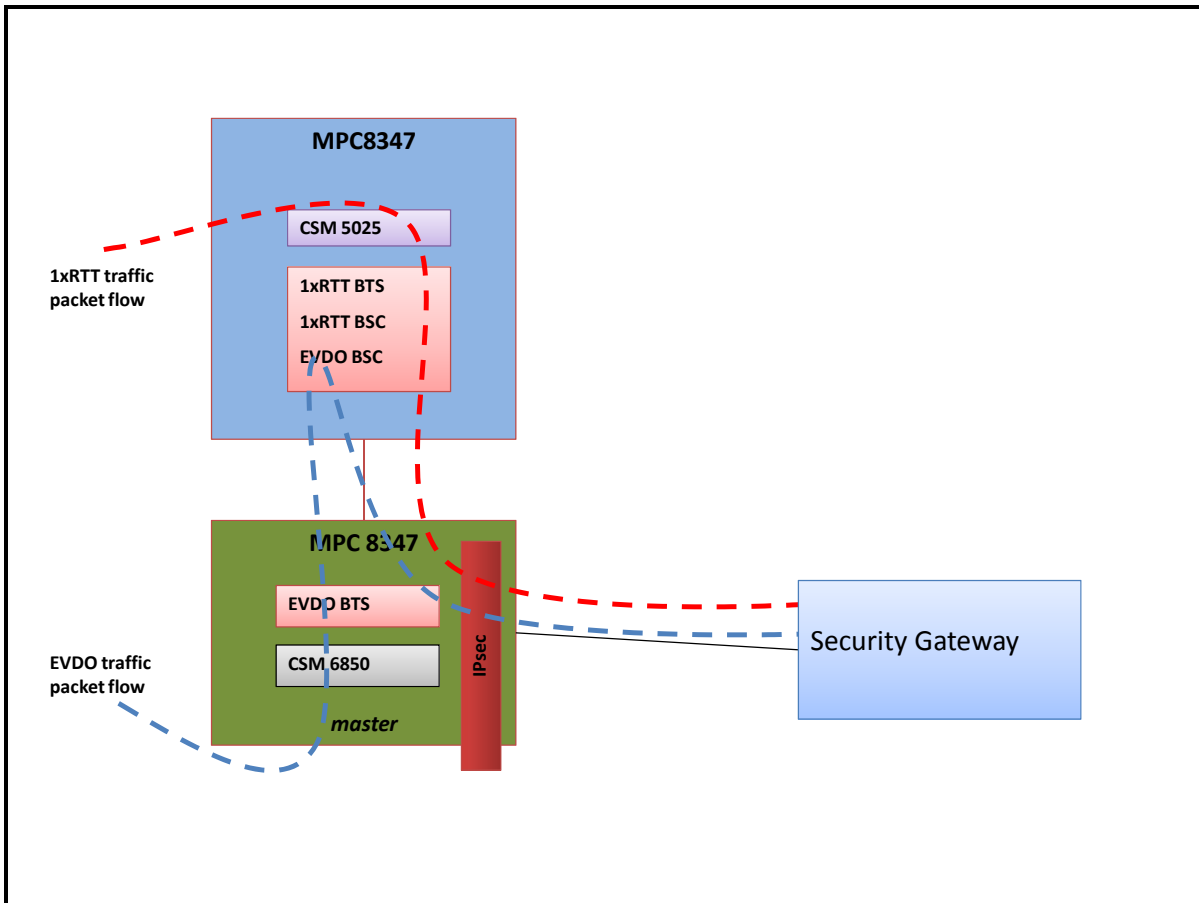


Figure 9 - PPC IP Packet Flow

3.3 Qualcomm chipsets

The EdgePoint Femto consists of two Qualcomm chipset. The CSM6825 handles the baseband signaling for the 1xEVDO portion. The CSM5025 handles the baseband signaling for the 1xRTT portion of the CDMA signal. In addition to providing 1xRTT baseband signal, 5025 also sends Pilot Beacon transmission to 1x mobiles. These chipset can support up to 28 simultaneous 1xRTT voice call, and 32 simultaneous 1xEVDO active data calls.

In addition to providing the call signal, Qualcomm chipsets also provide Pilot Beacon, PB, functionality that allows surround mobiles to redirect their RF signal to the EdgePoint PRO.

3.4 GPS Module

The GPS module is a essential part of the CDMA system due to the time sensitive nature of the technology. The GPS module provides synchronization of the local time and also location information. Below figure 10 shows the block diagram of GPS module to EdgePoint PRO components timing scheme.

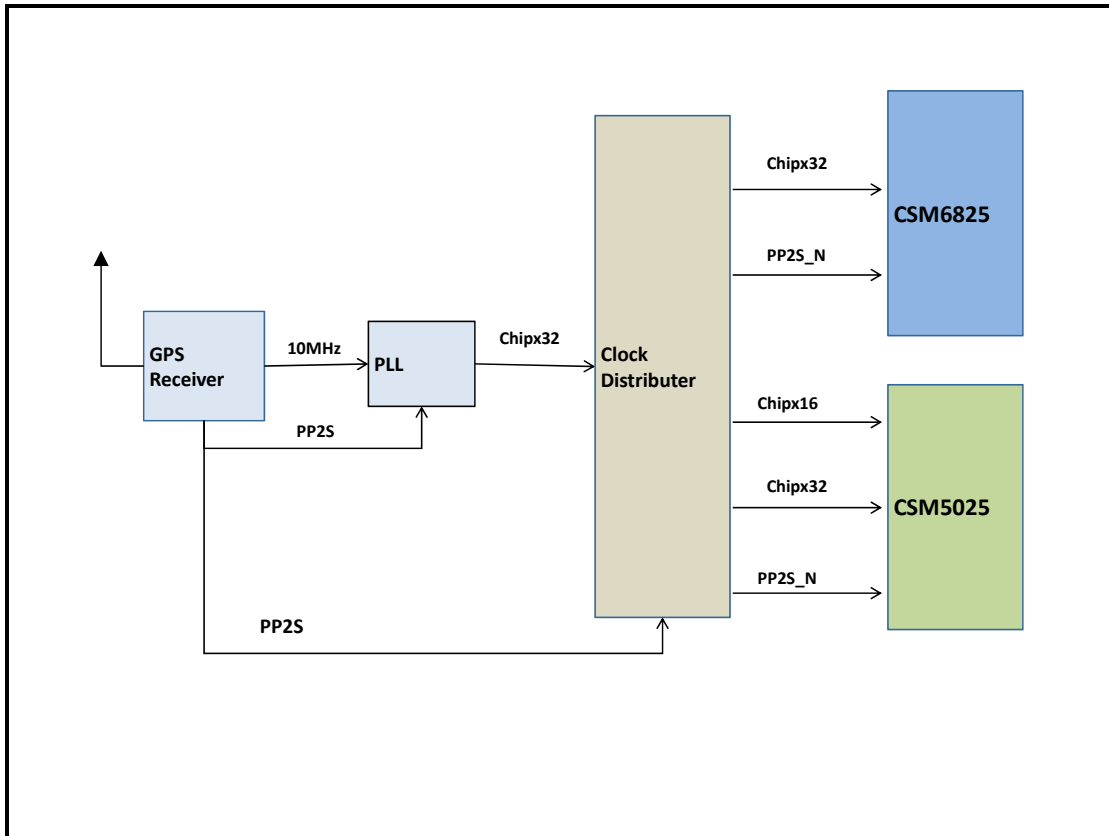


Figure 10 - EdgePoint Pro Timing Scheme

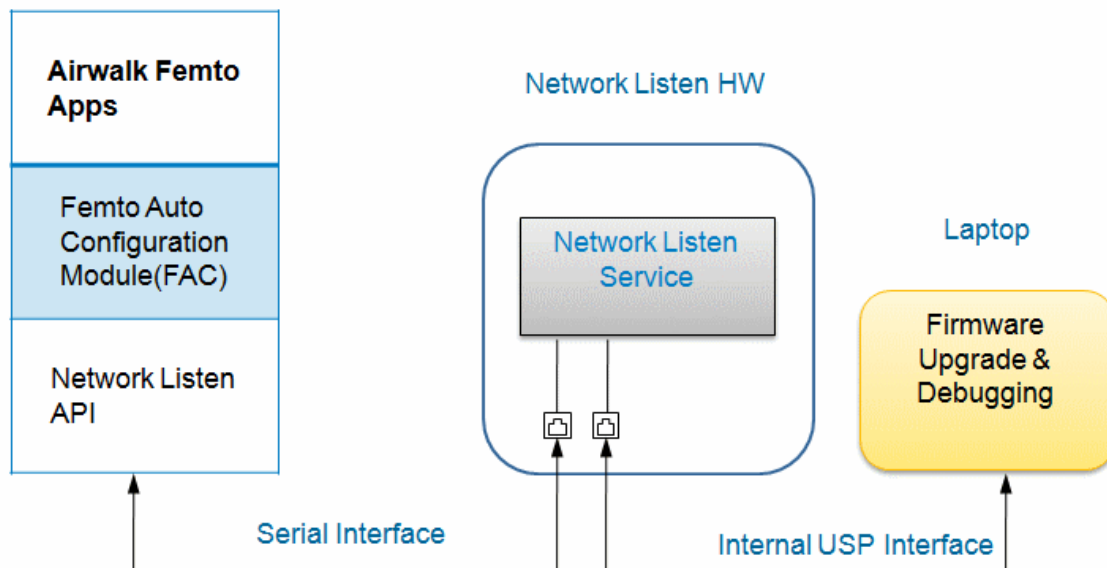


Figure 11 - Network Listener

3.5 Network Listen Function

The NL (Network Listener) function controls the mobile receiver in the EdgePoint PRO to obtain information on the current CDMA environment that the EdgePoint PRO is operating in. It sends this data to the U-BSM which uses predefined rules to determine the configuration of the radio environment. Figure 11 depicts interfaces and the components that are required for the NL to be operational. The NL is control through USB interface and need special firmware to be operational.

3.6 EFTR (Enterprise Femto Transceiver) Board

The EFTR is a module that gets signal from CSM chipsets and converts the signal to the RF components. The EFTR for EdgePoint PRO has 3 transmit paths:

1. CDMA1x
2. CDMA DO
3. Pilot Beacon

In addition, the FTRB provide 3 received path and 1 received path for the mobile receiver used for the NL. The 3 received paths have following roles:

1. CDMA 1x
2. CDMA DO
3. Noise Measurement Path-Second Receiver

The EFTR provide maximum output power of 0 dBm on each path. The received sensitivity is -115dBm. The signal from the EFTR is inputted to the built in amplifier, FEU. The EFTR uses Lime chip model LMS6002D. The EFTR is a module that will be selected based on different band classes.

3.7 1900 MHz EFTR

The 1900 MHz EFTR board

3.8 800 MHz EFTR

TBD

3.9 EdgePoint PRO FEU

The radio portion of the EdgePoint PRO is called an FEU, Front End Unit. It is connected to digital board, and is an RF amplifier that can transmit 200 mWatt. The Figure 12 shown below is a FEU picture from the top.



Figure 12 - FEU (Front End Unit)

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